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29 October 1965

MEMORANDUM FOR THE RECORD

SUBJECT: Evaluation of Final Report on Par 216

[REDACTED]

Background

PAR 216 of Contract [REDACTED] posed the problem of studying the effects of lasers on photographic materials and techniques. Its broad objective was to discern and define the similarities and the discrepancies between the use of lasers and the use of conventional, non-coherent light sources in the photographic processes. [REDACTED] undertook the problem on 6 February 1964 and completed the work on 15 January 1965 at a cost to the Government [REDACTED]. Three basic study areas were to be investigated: 1) film response and resolution, 2) effects of heat, 3) photographic processing. (Optimization of the laser will be considered under PAR 217.) The final report includes both findings and recommendations in response to our submitted request for research.

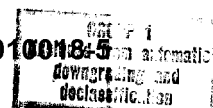
Evaluation

Probably the simplest way in which to appraise the final report, and indeed the entire study program, would be to separate the successes from the failures, the desired ends achieved from the desired ends neglected. Specific questions posed in our detailed research objective should have provided [REDACTED] with a framework from which to organize their work. How closely they aligned themselves with our statement of the problems must certainly be considered in evaluating the over-all performance and the competence of the contractor on this program.

Beginning with the area of film response and resolution, the broadly stated objective was the determination of the manner in which present and predictable future high resolution films are responsive to light energy in red and near infrared ranges. Specifically, any unique resolution characteristics were to be investigated and compared with shorter wavelength exposure. Nowhere in the final report is any mention made of attacking this problem. [REDACTED] has given us some verbal assurances that there are no real problems in this area -- that film responds to red and near infrared light much the same as it does to white light. However, never has [REDACTED] provided any substantive data to confirm these verbal assurances. Their primary effort was a comparison of coherent and non-coherent radiation, surely a valid consideration when approaching lasers,

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but only a partial one. Since lasers are, to date, found predominantly in the red end and not in the actinic end of the spectrum, such a requirement should have been treated in some detail. Any implications of resolution differences discovered would have been most crucial to future film development. The contractor regarded only radiation of the "same approximate wavelength and energy level." Although we suggested emphasis at one wavelength of especial interest, that of the laser enlarger, this stipulation should not have been totally confining.

A second specific objective was to determine the effects upon resolution of the interference phenomena resulting from diffractions caused by the interaction of lasers' coherent beam and a turbid media such as a silver halide emulsion. Other than mentioning that "if the light is coherent there will be interference fringes," [] defines no quantitative aspects of this problem. Their use of a periodic photographic input (a scaled rule) in conjunction with this objective was an extremely poor procedure since spurious focusing effects obtained from such repetitive images void any results obtained. Their contention that dust and scratches or any other foreign particles in the beam will cause problematical diffraction patterns is certainly valid; however, this is no news to anyone.

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The second broad goal of PAR 216 was a definition of the effects, if any, of laser-generated heat upon photographic film. Verbal assurance that heat would not play a significant role was received from [] however, they neither confirmed nor obviated any such concern in their final report. Specific questions involving film dimensionality and plasticity alteration and increased rates of emulsion deterioration were completely ignored. Although undoubtedly difficult to attain experimentally, quantitative answers are sorely needed if we are ever to promote lasers in photographic systems.

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The third and final broad area delineated was that of the photographic processing of laser-exposed materials -- the determination of whether or not new and different processing techniques must be employed for films exposed with coherent radiation. [] treatment of this particular topic was somewhat more substantial than those previously mentioned. They investigated the possibilities of a difference in gamma existing between similarly exposed emulsions, one with coherent light, the other with non-coherent light. Their finding of no significant gamma discrepancy apparently led to the conclusion that special processing is not necessary for lasered photo-emulsions, although such reasoning is not explicitly confirmed in the final report.

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In all, this project must be appraised as quite inadequate in both design and experimental procedure. Its results, as reflected in the

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report, are entirely too meager to have merited the time and funds allotted. It is highly probable that a short period of concentrated study by our Exploratory Development Laboratory Branch (as it now exists) could have produced similar, if not vastly superior, results. In addition to substantially oversimplifying the stated objectives, the contractor has shown virtually no evidence of any awareness of related research being performed outside his own facilities. Only as an after-thought in the final report is any mention made of supportive literature, and nowhere has any imagination been exhibited in relation to future developments in the field of laser photography. In conclusion it must be judged that work on PAR 216 has not been particularly beneficial to the state-of-the-art or to the Government.

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